CLAIMS

We claim:

1. An isolated nucleic acid molecule encoding vertebrate telomerase.

2. The isolated nucleic acid molecule according to claim 1 wherein said vertebrate is a human.

3. The nucleic acid molecule of claim 1, wherein the nucleic acid molecule comprises the sequence presented in Figure 1, or hybridizes under normal stringency conditions to the complement of the sequence presented in Figure 1, provided that the nucleic acid molecule is not EST AA281296.

4. The nucleic acid molecule of claim 1, wherein the nucleic acid molecule encodes the amino acid sequence presented in Figure 1 or 11, or variant thereof.

5. An isolated nucleic acid molecule encoding any of the amino acid sequences presented in Figure 11, or hybridizes under normal stringency conditions to the complement of the sequences thereof, provided that the nucleic acid molecule is not EST AA281296.

6. An isolated nucleic acid molecule comprising any of the sequences presented in Figure 10, or hybridizes under normal stringency conditions to the complement of the sequences thereof.

7. An oligonucleotide comprising from 10 to 100 contiguous nucleotides from the sequence presented in Figure 1 or its complement.

8. An oligonucleotide comprising from 10 to 100 contiguous nucleotides from the sequences presented in Figure 10 or the complements thereof.

9. The oligonucleotide of either of claims 7 or 8, wherein the oligonucleotide is labeled.

10. The oligonucleotide of claim 9, wherein the label is a radiolabel, a chemiluminescent label, or biotin.

11. An expression vector comprising a heterologous promoter operably linked to a nucleic acid molecule according any of claims 1-6.

12. The expression vector of claim 11, wherein the vector is selected from the group consisting of bacterial vectors, retroviral vectors, adenoviral vectors and yeast vectors.

13. A host cell containing a vector according to either claims 11 or 12.

14. The host cell of claim 13, wherein the cell is selected from the group consisting of human cell, monkey cell, mouse cell, rat cell, yeast cell and bacterial cell.

15. The host cell of claim 13, wherein the cell is a human cell.

16. An isolated protein comprising a vertebrate telomerase protein.

17. The protein of claim 16, wherein the vertebrate is a human.

18. The protein of claim 16, wherein the protein comprises the amino acid sequence presented in Figure 1 or 11, or variant thereof.

19. A portion of a vertebrate telomerase protein.

20. The portion of claim 19, wherein the amino acid sequence of the portion is presented in Figure 1.

21. The portion of claim 19, wherein the amino acid sequence of the portion is presented in Figure 11.

22. The portion of claim 19, wherein the portion is from 10 to 100 amino acids long.

23. An antibody that specifically binds to the protein according to either claim 16 or 19.

24. An antibody that specifically binds to a polypeptide encoded by a sequence selected from the group consisting of region 1, region α, region β, region 2 and region 3.

25. The antibody according to claim 24, wherein the antibody is a monoclonal antibody.

26. A hybridoma that produces an antibody according to claim 14.

27. A nucleic acid probe that is capable of specifically hybridizing to a nucleic acid molecule encoding a vertebrate telomerase under conditions of normal stringency, provided that the probe does not hybridize to nucleotides 1624-2012 presented in Figure 1.

28. The probe of claim 27, wherein the probe is from 12 to 200 nucleotides long.

29. The probe of claim 27, wherein the probe is from 20 to 50 nucleotides long.

30. The probe of claim 17, wherein the nucleic acid molecule has the sequence presented in Figure 1 or its complement thereof.

31. The probe of claim 17, wherein the nucleic acid molecule is labeled.

32. A pair of oligonucleotide primers capable of specifically amplifying all or a portion of a nucleic acid molecule encoding human telomerase.

33. The primers of claim 32, wherein the nucleic acid molecule comprises the sequence presented in Figure 1 or its complement.

34. The primers of claim 32, wherein the nucleic acid molecule comprises any of the sequences presented in Figure 11 or the complements thereof.

35. The primers of claim 32, wherein the pair of primers is capable of specifically amplifying sequence comprising all or a part of region 1, region α, region β, region 2, region 3, region X or region Y.

36. The primers of claim 35, wherein the primers flank nucleotide 222, 1950, 2131-2166, 2287-2468, 2843, or 3157 as presented in Figure 1.

37. The primers of claim 36, wherein only one of each primer pair flanks nucleotide 222, 1950, 2131-2166, 2287-2468, 2843, or 3157 as presented in Figure 1 and the other primer of the pair has sequence corresponding to one of the sequences presented in Figure 10 or complements thereof.

38. A pair of oligoprimers capable of specifically amplifying genomic sequence presented in Figure 10, wherein the primers amplify more than nucleotides 1 to 38.

39. An oligonucleotide that hybridizes specifically to a nucleic acid sequence in region 1, region α, region β, region 2, region 3 region X or region Y.

40. The oligonucleotide of claim 39, wherein the oligonucleotide is from 15 to 36 bases.

41. A method of diagnosing cancer in a patient, comprising preparing tumor cDNA and amplifying the tumor cDNA using primers that specifically amplify human telomerase nucleic acid sequence, wherein the detection of telomerase nucleic acid sequences is indicative of a diagnosis of cancer.

42. The method of claim 41, further comprising comparing the amount of amplified telomerase sequence to a control, wherein increase telomerase nucleic acid sequences over the control is indicative of a diagnosis of cancer.

43. The method of claim 41, wherein the primers span region 1, region α, region β, region 2, region 3 region X or region Y, wherein the pattern of amplification is indicative of a diagnoses of cancer.

44. The method of claim 43, wherein the primers are Htel Intron T and Htel 723B.

45. The method of claim 44, wherein the primers are Htel335T and Htel1022B.

46. A method of determining a pattern of telomerase RNA expression in cells, comprising preparing cDNA from mRNA isolated from the cells, amplifying the cDNA

using primers according to claim 35, therefrom determining the pattern of telomerase RNA expression.

47. The method of claim 46, further comprising detecting the amplified product by hybridization with an oligonucleotide having all or part of the sequence of region 1, region α, region β, region 2, region 3 region X or region Y.

48. A method of diagnosing cancer in a patient, comprising determining a pattern of telomerase RNA expression, comprising amplifying telomerase from cDNA synthesized from tumor RNA, and detecting the amplified product by hybridization with an oligonucleotide having all or part of the sequence of region 1, region α, region β, region 2, region 3 region X or region Y, therefrom determining the pattern of telomerase RNA expression, wherein the pattern is indicative of a diagnosis of cancer.

49. The method of claim 48, further comprising comparing the pattern to a pattern obtained from a reference cancer.

50. A non-human transgenic animal whose cells contain a vertebrate telomerase gene that is operably linked to a promoter effective for the expression of the gene.

51. The animal of claim 50, wherein the animal is a mouse.

52. The animal of claim 50, wherein the promoter is tissue-specific.

53. The animal of claim 50, wherein the telomerase gene is any of the nucleic acid sequences presented in Figure 11.

54. A mouse, whose cells have an endogenous telomerase gene disrupted by homologous recombination with a nonfunctional telomerase gene, wherein the mouse is unable to express endogenous telomerase .

55. An inhibitor of vertebrate telomerase activity, wherein the inhibitor binds to telomerase and is not a nucleoside analogue.

56. The inhibitor of claim 55, wherein the vertebrate is a human.

57. The inhibitor of claim 55, wherein the inhibitor is antisense nucleic acid complementary to human telomerase mRNA.

58. The inhibitor of claim 57, wherein the antisense is complementary to region α, region β, region 2, region 3 or region X.

59. The inhibitor of claim 55, wherein the inhibitor is a ribozyme.

60. A method of treating cancer, comprising administering to a patient a therapeutically effective amount of an inhibitor according to claim 55.

61. A nucleic acid molecule comprising the sequence selected from the set consisting of sequences selected from region 1, region α, region β, region 2 or region 3 as presented in Figure 10 and variants thereof.

62. A method of identifying an effector of telomerase activity comprising:

(a) adding a candidate effector to a mixture of telomerase protein, RNA component and template, wherein the telomerase protein is encoded by an isolated nucleic acid molecule according to claim 1;

(b) detecting telomerase activity; and

(c) comparing the amount of activity in step (b) to the amount of activity in a control mixture without candidate effector, therefrom identifying an effector.

63. The method of claim 62, wherein the effector is an inhibitor.

64. the method of claim 62, wherein the nucleic acid molecule encodes human telomerase.

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